CHAPTER VII
CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

Firstly, the biosensor for glucose detection was studied. We have shown that a PPy/PAN–MWCNT/SPCE can be fabricated using electrospinning and vapor-phase polymerization techniques. The presence of a conductive nanofiber structure coated with a PPy layer on the SPCE surface enhances the electrochemical redox activity, where the resulting current is produced by radial diffusion and is quasi-reversible with an excellent anodic/cathodic current response and a low ΔE_p in a $Fe(CN)_6^{3-/4-}$ redox-couple system. In the case of standard H_2O_2 detection, the PPy/PAN–MWCNT/SPCE gave a well-defined electrocatalytic response, which indicated that the modified electrodes behave as a disposable device with an anodic current greater than that of the conventional planar SPCE and could be used to measure H_2O_2 over a wide concentration range from 0.125 to 10 mM. The incorporation of GOX as an enzymatic model with the PPy/PAN–MWCNT/SPCE led to glucose detection over a linear range of 0.25-6 mM. In addition, The experimental results showed that mediator retained its catalytic activity with low K_m value and increase sensitivity and linear range of detection. This work represents our first report on SPCE surface modification. In future works, enzymatic immobilization on a PPy layer will be investigated.

Secondly, the biosensor for dopamine detection was firstly studied by using a carbonized composite nanofiber containing G particles prepared by electrospinning and carbonization processes. A modification method involving drop-casting CPAN5G-4x suspended in water onto an SPCE working electrode resulted in enhanced electrochemical activity toward the ferri/ferrocyanide redox couple and DA, as measured using CV and SWV, respectively. The carbonized nanofiber/G composite enabled excellent electron transfer between the DA molecules and electrode surface in the presence of SDS and interferents (AA and UA). This modified electrode was able to determine the presence and quantity of DA in human serum with higher sensitivity and a lower LOD than several previous surface modifications. This simple

modification method can likely be used for the fabrication of other high-performance biosensors.

Finally, the best result from second work was successfully persevered by using a Au/G hybrid achieved by a combination of electrospinning and carbonization processes. The nanowire was embedded on the SPCE surface, which was used as the DA sensing platform. The CV and DPV results showed that CPAN-Au/G had enhanced electrochemical activity toward the ferri/ferrocyanide redox couple and DA. The CPAN-Au/G electrode was used to determine DA in the presence of AA and UA, and the results showed well-defined oxidation peaks with larger peak separation and larger current density than other modified electrodes and bare SPCE. Although many previous studies have been reported on graphene and gold-modified electrode composites, the approach in this study was more practical, and the SPCE electrode was easy to prepare by drop casting without sacrificing high selectivity and high sensitivity. This study demonstrated that the CPAN-Au/G electrode could be promising for the construction of bioelectronics and biosensors for use in many real applications.

7.2 Recommendations

In these works show firstly all novel fabrications involved with electrospun materials loading with active substances such as MWCNT and grapheme particles incorporating with the carbonization and vapor-phase polymerization processes. All electrospun materials can be potentially used as substances with high sensitivity properties in electrochemical sensor especially in oxidation reaction. The surface modifications of carbonization of electrospun PAN products could be treated with various chemical reactions in order to obtain the specific functional group such as amino and carboxylic group which can be immobilized antigen, enzyme and bio-molecules by using crosslink agent to develop a new biosensor for use as medical applications.